



Alkali-Aggregate Reactions in Hydroelectric Plants and Dams

Sponsored by ... Acres International Ltd.

What are Alkali-Aggregate Reactions?

Alkali-aggregate reactions occur between certain aggregate types and the alkali's in the pore solutions of the cement paste in concrete to form a silica gel or carbonate reaction products. In the presence of free moisture, the gel will expand and manifest in cracking and differential movements in structures as well as other deleterious effects such as reduction in freeze-thaw durability and compressive and tensile strength.

Aggregates which may cause the three types of AAR are classified in Supplement No. 2-1986 to CSA Standard CAN3-A23.1-M77 1986. Three forms of AAR generally affect hydroelectric structures

- the alkali-silica reaction [ASR](#)
- the slow/late-expanding type of reaction, referred to here as the alkali-silicate/silica [ASSR](#) reaction
- the alkali-carbonate reaction [ACR](#).

Expansion of the concrete due to AAR can result in

- binding of spillway gates (Mactaquac),(Hiwasee)
- excessive deformations and cracking of dams (Fontana), (Hiwasee),(Mactaquac)
- distortion of embedded mechanical parts (Chickamagua Powerhouse), (Mactaquac)

Generally, damage of this type has been mitigated by certain remedial measures and very few structures have required actual replacement (e.g., American Falls, Lady Evelyn Lake Dam) although not due to the AAR compromising safety insomuch for serviceability and economic reasons.

Webmaster: Mike Hughes, mhughes@nf.acres.com.

Copyright [Acres International Ltd.](#), Niagara Falls, Ontario, Canada.

Created: 11/11/95 Updated: 12/24/95
